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ABSTRACT

Previous research indicated that immigrant generational status has significant impact on the educational achievement of Asian American students. However, no study has been conducted on the consistency and variability of the impact in different subject areas across different grade levels. This study identified 950 Asian American high school students from the National Education Longitudinal Study of 1988 (NELS:88) and explored the effect of generational status in 4 areas (reading, mathematics, science, and social studies) at 3 grade levels (8, 10, and 12). Multivariate analysis of variance and multiple regression analyses were applied to test scores at the three grade levels, and the change of test scores across the high school years was modeled by covariance structure analysis. The results show that Asian American students of the first and second generations had better academic performance at each grade level and faster growth across the years than those of the third and later generations. It was also found that mathematics and science were the two subject areas that distinguished the first two generations from later generations. The observed generational differences in the academic performance and its growth were significant after controlling for the effects of major background characteristics. (Contains 6 tables, 1 figure, and 35 references.) (Author/SLD)

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Running head: GENERATIONAL DIFFERENCES IN ACHIEVEMENT

# Immigrant Generational Differences in Academic Achievement and Its Growth: The Case of Asian American High School Students

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Revised version of a paper presented at the Annual Meeting of the American Educational Research Association (Seattle, WA, April 10-14, 2001)

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## Abstract

Previous research indicated that immigrant generational status has significant impact on the educational achievement of Asian American students. However, no study has been conducted on the consistency and variability of the impact in different subject areas across different grade levels. This study identified 950 Asian American high school students from the National Education Longitudinal Study of 1988 (NELS:88) and explored the effect of generational status in four subject areas – reading, mathematics, science, and social studies – and at three grade levels (8, 10, and 12). MANOVA and multiple regression analyses were applied to test scores at the three grade levels, and the change of test scores across the high school years was modeled by covariance structure analysis. The results showed that Asian American students of the first and second generations had better academic performance at each grade level and faster growth across the years than those of the third and later generations. It was also found that mathematics and science were the two subject areas that distinguished the first two generations from later generations. The observed generational differences in the academic performance and its growth were significant after the effects of major background characteristics were controlled for.

# Immigrant Generational Differences in Academic Achievement and Its Growth: The Case of Asian American High School Students

## Introduction

In educational and psychological literature, Asian Americans are traditionally characterized as a "model minority" -- acculturated, assimilated, and financially successful. Asian American students have typically been seen as hardworking high-achievers, especially in mathematics and science. Since the early 1990s, studies began to pay more attention to different sub-groups of Asian Americans who actually represent many diverse cultures and complex communities, both those recently arrived and those of long standing in the United States (Pang, 1995). For example, recent literature reveals various attempts to address the social, psychological, and academic problems experienced by Asian American students of specific regional and ethnical backgrounds (e.g., Braxton, 1999; Gao, 1995; Lee, 1994; Toupin & Son, 1991; Heras, 1985).

Generational status is an important factor linked to the educational achievement of immigrant populations. Several studies (Rong & Grant, 1992; Grant & Rong, 1999; Kao & Tienda, 1995; Kaufman et al., 1998) in the past ten years have explored the impact of generational status on Asian American student achievement. In general these studies concluded that students of the second generation tended to have the highest achievement, and that achievement tended to decline in later generations. This study extends the scope of previous studies by modeling the generational effect on Asian American student achievement in both cross-sectional and longitudinal ways. Using the data of the National Education Longitudinal Study of 1988 (NELS:88), this study found that Asian American high school students of different generations evidenced different

growth rates in academic achievement as well as different performances at specific grade levels, and such differences varied with subject areas and remained significant after controlling for the impacts of other background characteristics.

## Generational status and academic achievement

The theories on the adaptation of immigrant populations into U.S. society can be classified under two major models, classical assimilation and segmented assimilation.

The classical assimilation model (Park, 1928; Gordon, 1964) was based on the experiences of European immigrants in the early twentieth century. According to this model, later generations of immigrants would become more successful in American society because they were more assimilated into mainstream American culture. First generation immigrants normally could not gain economic and social equality with the "native" populations because they faced severe obstacles such as the lack of fluency in English and the lack of knowledge about American society. Second generation immigrants tended to be better educated, and therefore better able to overcome the obstacles faced by their parents, thus they had far more chance to succeed in the United States. As the model assumed a positive relationship between cultural assimilation and the level of success in the United States, it was expected that the third and later generations of immigrants would become more similar to mainstream Americans and therefore even more successful socially and economically.

While the classical assimilation model may apply to some early European immigrant groups, it has been shown that the model is unable to represent the immigration process of most non-European populations who are racial minorities in the United States. Based on studies of Hispanic and Asian immigrants, an alternative model

called segmented assimilation was proposed (Portes & Rumbaut, 1996; Gibson, 1995). According to the new model, different immigrant groups would follow different paths at different rates in the process of assimilation, and the "success story" in American society would also vary with the characteristics of these groups and the particular environment in which they found themselves. Unlike the classical model, the segmented assimilation process indicates that for an immigrant group, the existence of successive generations in the United States does not necessarily mean more intensified assimilation into the mainstream culture, nor does it mean greater economic and social success in American society.

In terms of educational performance, the classical assimilation theory would predict sustained improvement by later generations of immigrants. Such a proposition has been challenged by studies on the generational differences in academic achievement of Asian American immigrants since early 1990s. Using national databases, researchers found that while the second generation tended to make significant progress, the third and later generations exhibited a persistent pattern of lower educational attainment.

Using a sample of 22,695 respondents aged 14 to 24 drawn from the 1979 Current Population Survey (CPS), Rong and Grant (1992) performed a cross-sectional study of the effects of ethnicity and immigrant generational status on the educational attainment (measured by years of schooling) of Asian, Hispanic, and White populations. Generational status was determined by the birthplaces of the respondents and their parents, and it consisted of three categories: immigrants (foreign-born respondents with non-American parents); children of immigrants (US-born respondents with one or two foreign-born parents); and natives (US-born respondents with both parents born in US).

They observed that in general children of immigrants attained more years of schooling than did first generation immigrants, and the educational attainment of Asian Americans appeared to peak in the children of immigrants, and level off after that generation.

In another study, Grant and Rong (1999) elaborated on the topic of the educational attainment of immigrants in a comparative study of five ethnic groups (White, Black, Asian, Mexican, and Other Hispanic) using the data from the1989 Current Population Survey (CPS). For Asian Americans, they found similar results that generational status had significant impact on schooling after controlling for the effects of gender, age, and income. Also they found that second generation students (the children of immigrants) outperformed the other generations in terms of educational attainment.

Kao and Tienda (1995) used the base year data of the National Education Longitudinal Study of 1988 (NELS:88) to examine the effects of generational status on three indicators of educational achievement: school grades, achievement test scores (reading and mathematics), and college aspirations. They determined generational status in a manner similar to Rong and Grant, but used the mother's birthplace, rather than those of both parents. Comparing Asian American eighth graders with their Hispanic, Black, and White peers, the authors found that generational status influenced the four ethnic groups differently, and that Asian Americans were the only group for which the impact of generational status was significant on all the three indicators – school grades, test scores, and college aspirations. Among Asian Americans, it was found that first and second generation students had higher school grades as well as higher mathematics and reading test scores, and those students were more likely to aspire to graduate from college than

third generation students. There was no significant difference in educational performance between the first and second generations of Asian American students.

Another study using the NELS:88 data to explore the relationship between immigrant generational status and educational achievement was conducted by Kaufman, Chavez, Lauren, and Caroll (1998). The authors compared Asian and Hispanic students of the 1988 high school cohort who were surveyed again every two years. They classified the students into three generational groups in the same way Rong and Grant did. In terms of academic achievement assessed by reading, mathematics, and science proficiencies, the authors found that Asian American students were more likely to be above the proficiency levels in mathematics and science than their Hispanic peers, and the difference was observed in each of the three generations. Among the Asian American students, the authors observed significant difference between the second and the third generations in terms of their likelihood of being above the proficiency level in mathematics. Again, second generation students demonstrated better performance.

The findings of these studies provided evidence for the segmented assimilation model of immigration in terms of the different effects of generational status among different immigrant groups and the decline of educational attainment after the second generation. However, some aspects of the phenomenon of the generational difference in Asian American educational achievement have not been explored. For example, there is no study on the consistency and variability of the impact of generational status on Asian American students in major subject areas and at different grade levels. More importantly, the previous studies were almost exclusively cross-sectional and they were unable to analyze the generational impact on educational development or growth. The census data

(in Rong and Grant's studies, for example) are cross-sectional "snapshots" that cannot provide information on the educational development of immigrant populations (Rong & Brown, 2001). The NELS data, on the other hand, are longitudinal by nature. However, the NELS data have not been used to model the educational growth of different generations of a specific immigrant group such as Asian Americans.

Consequently, this study sought to find out: Does the effect of generational status on the Asian American student achievement have a consistent pattern across the three grade levels and the four subject areas surveyed by the NELS study? Does the pattern of generational difference hold after controlling the influences of other background characteristics? The present study also examined the following research questions: Do Asian American students of different generations differ in their rate of growth in academic achievement? What is the pattern of such differences? And how do the observed differences vary among the subject areas in the context of other background characteristics?

## Modeling academic growth: A short note on methodology

The second set of research questions of the study involve growth curve modeling of academic performance. A brief account of the related methodologies is provided in this section.

Individual growth modeling usually consists of two levels. Level one, or the within-person model, represents the change that each person experiences with time. Different people may have different values of the individual growth parameters (i.e., the initial status and the rate of change). Level two, or the between-person model, represents

the hypothesized link between individual growth parameters and some inter-individual predictors of change.

There are a variety of methods to model individual growth. One of them is the ordinary least squares (OLS) regression based method that estimates level one and level two parameters separately (Rogosa & Willett, 1985; Willett, 1994). An expansion of the OLS method is the weighted least squares (WLS) estimation that obtains asymptotically efficient estimates of the parameters of the level two model (Willett, 1988). More recently, hierarchical linear modeling (HLM) has become a popular tool for modeling educational change for its ability to estimate simultaneously the parameters at both level one and level two using an empirical Bayes algorithm (Bryk & Raudenbush, 1992).

Individual growth can also be modeled by covariance structure analysis. Meredith and Tisak (1990) provided a framework that permitted the evaluation of the general shape of individual growth curves, as well as the estimation of the means, variances, and covariances of level two parameters. McArdle and Epstein (1987) demonstrated how level two relationships between the rate of change and a single predictor of change could be modeled and estimated. Muthén (1991) also demonstrated that covariance structure models could be used to estimate multilevel data and the parameters of a linear individual growth model could be allowed to vary across individuals in ways systematically related to selected time-varying and time-invariant predictors of change.

It has been pointed out (Willett & Sayer, 1994; see also Kaplan, 2000) that the integration of individual growth modeling and covariance structure approaches is based on the fundamental mathematical equivalence of two alternative methods of representing

the same data structure. The process of formulating level one and level two models for individual change and for systematic inter-individual differences in change is equivalent to postulating a specific structure for the matrix of covariances among the multiple waves of observed data and the predictors of change.

The above brief discussion on modeling growth with covariance structure analysis sketches the methodological background for the second analyses of this study, where the author attempted to model the academic growth of Asian American students from the base year and through two follow-ups of the NELS:88.

## Method

### Data source

All analyses of this study were based on variables generated from the database of the National Education Longitudinal Study of 1988 (NELS:88). NELS:88 was designed as a nationally representative sample of 26,435 eighth-grade students of 1988 from 1,052 schools. Extensive data were collected about students and their environment in the base year of 1988 and in periodic follow-ups.

### Sample

The study identified 950 Asian American students from the NELS:88 database. After 87 cases were deleted because of missing values on the variables necessary to create the generational status variable, 863 students remained. All the analyses were based on the sample weighted to compensate for unequal probabilities of selection in complex sampling design (National Center for Educational Statistics, 1996). The weights were normalized to restore the original sample size for estimation (see Kaplan & Ferguson, 1999, for a discussion of the normalization of sampling weights).

Variables

In the NELS data, test scores of reading, mathematics, science, and social studies (combining history, citizenship, and geography) were used as the major indices of academic achievement. In this study, the item response theory (IRT) based scores were used. These scores have been scaled in a way that enables direct comparisons over the years, ideal for longitudinal studies (National Center for Educational Statistics, 1994). For example, there are three scores for math achievement, the grade 8 math scores from the base year (1988), the grade 10 math scores from the first follow-up (1990), and the grade 12 math scores from the second follow-up (1992).

There is no ready-made variable for generational status in the NELS:88 data. Instead, the variable named Generational Status was constructed from three separate variables (the student's place of birth, the mother's place of birth, and the father's place of birth). As in previous studies, the first generation (Generation One) refers to Asian American students born outside the United States (typically called first generation immigrants); the second generation (Generation Two) refers to US-born students with one or both parents born outside the US (typically called second generation immigrants or children of immigrants); and the third generation and after (Generation Three) refers to US-born students whose parents were also US-born (typically called natives). In this study, there were 441 Generation One students, 294 Generation Two students, and 128 Generation Three students.

Besides Generational Status, five variables were specified to cover the major background characteristics of Asian students. Socio-economic status (SES) is a standardized composite variable that incorporates the parents' highest education,

occupation, family income, etc. NELS:88 provided SES information for each year surveyed. Preliminary analysis showed that the three measures of SES were perfectly correlated. Therefore only the base year (1988) assessment of SES was used in the analyses.

The Limited English Proficiency (LEP) variable was coded 1 for students who were determined to have limited English proficiency at grade 8 (1988) and 0 for the non-LEP student. It was used to account for the variance in English ability among Asian American students, especially between those born in and those born outside the United States.

East Asian Origin was a dummy variable created to differentiate the national and regional origins of the students. It was coded 1 for students from the three East Asian countries (China, Japan, and Korea) and 0 for those from other areas. East Asian Origin was specified as a background variable because the students from this area formed a large subgroup (32.2% of the sample had East Asian origins) and because there are distinctive cultural values traditionally attributed to them (Schneider & Lee, 1990; Goodnow, 1998).

Parental Expectation measured the level of education that parents wanted the student to obtain, as perceived by the student. It was coded on a six-point scale with the lowest end standing for "less than high school" and the highest end for "higher than college". Like SES, Parental Expectation was assessed by each of three waves of data collection, with a correlation around .35. Thus for each student, the variable took three different values in the analyses.

The last variable Gender was coded 1 for female and 0 for male. There were 424 female students and 439 male students in the sample.

Procedures

To answer the first group of questions, multivariate analysis of variance (MANOVA) was conducted on the average scores in the four subject areas of the three generational groups at grades 8, 10, and 12. The aim was to find out the pattern of generational differences in academic achievement across grade levels and subject areas.

The robustness of the observed pattern of generational difference was then tested in the context of other background variables by multiple regression analysis. For each grade level, test scores of the four subject areas were modeled by block-entry regression. The first block of independent variables included two dummy variables for Generational Status, while the second block included the five background variables SES, Gender, East Asian Origin, Limited English Proficiency, and Parental Expectation.

To answer the second group of questions, growth curve models were estimated by covariance structure analysis for each subject area. For each model, the initial status of achievement was set to grade 8 (1988). Linear growth trajectories were assumed in all models after individual growth curves of ten randomly selected subjects were examined (see Willett & Sayer, 1994). The structural equation modeling software AMOS 4.0 (Arbuckle, 1999) was used in this study.

## Results

Multivariate analysis of variance (MANOVA) showed that the multivariate effect of generational status on mathematics, reading, science, and social studies scores was highly significant ($p < .001$) at each grade level. Univariate analysis of the test scores indicated that generational effect was also highly significant for each subject area at each grade level.

Table 1 displays the average scores of the four subject areas by each generation and how they differed from each other based on multiple comparisons. From the table it is clear that the Asian American students of Generation Two significantly outperformed the other two groups in each subject area at each grade level. At the same time, Generation One students outperformed Generation Three students in math, science (with one exception at grade 8), and social studies.

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Insert Table 1 and Table 2 about here

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The basic descriptive statistics of the background variables for the three generations of Asian American students are presented in Table 2. The table shows that Generation Two students had significantly higher SES than the other two generations, which corresponds to their highest test scores. However, Generation One students had significantly lower SES than Generation Three students, in contrast to the former group's better test scores. About 6% of students were classified as LEP in 1988, among which 92% were Generation One. The proportion of LEP students in the Generation One group (11%) was significantly higher ($p < .001$) than that of the other two groups.

The generational difference in the students' perceived parental expectation varied over the years. At grade 10, the difference corresponded to that of test scores, all significant at the .001 level. However, at grade 8 and grade 12, students of the first two generations perceived higher parental expectation than did the third generation ($p < .001$) while the difference between the first two generations was insignificant. Among the students with East Asian origins (32% of the whole sample), about 87% were from the

first two generations. The proportions of East Asian students in the first two generations were close to each other while both significantly higher ($p < .001$) than that of the third generation. The proportions of male and female students in the three generational groups were nearly equal.

The generational differences in test scores observed above were then put into the context of other background characteristics in multiple regressions. Table 3 lists the standardized coefficients from the multiple regression analyses and the proportions of variance the models explained. In these twelve models, Generational Status was represented by two dummy variables, Generation One and Generation Three, corresponding to the contrast between the second generation and the first and third generations.

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Insert Table 3 about here

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When Generation One and Generation Three were the only independent variables (under the heading of Model 1 in Table 3), they basically replicated the information produced by earlier MANOVA analyses, and they accounted for about 5 to 8 percent of the total variance in the test scores.

When the five background variables entered the models along with the above two variables for Generational Status (under the heading of Model 2 in Table 3), the advantage of Generation Two over Generation Three remained significant in each subject area. However, their advantage over Generation One students was no longer significant

in mathematics, science, or social studies. The exception was found in the reading scores where the Generation Two advantage continued to be significant at each grade level.

When the above models were re-estimated using two dummy variables representing the contrast between Generation Three and the first two generations, it was found that Generation One students outperformed Generation Three students at all three grade levels, and significantly ($p < .001$) in mathematics and science.

To summarize, the results of the first analyses indicated that Asian American students of the first two generations outperformed the third generation in mathematics and science, while Generation Two students outperformed the other two generational groups in reading. Such differences held after controlling for the impacts of other background variables.

The second analyses focused on the academic growth of the Asian American students surveyed by the NELS study. For each subject area, three growth curve models were specified and estimated. The specifications of the three models and the estimated parameters will be illustrated using the example of math scores. The path diagram of the third or full growth model is shown in Figure 1.

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Insert Figure 1 about here

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In the first model, the two dummy variables, Generation One and Generation Three, were used as predictors of the initial status and the growth rate of math achievement. The initial status and the growth rate were correlated by way of their

residuals. All predictor variables were allowed to correlate with each other in this model and in subsequent models.

The estimated effects and the model fit indices are shown under Model 1 in the second column of Table 4. The average initial status of Generation Two students (the reference group) was 44.941 points and the scores tended to grow by 6.664 points every two years. The results showed that the math scores of Generation Two students increased at a significantly higher rate ($p < .01$) than Generation Three students, while the difference between the first two generations was insignificant. The pattern of generational differences in the initial status (grade 8 math) was identical to that from earlier regression analyses. The correlation between the initial status and the growth rate was trivial ($r = -.04$).

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Insert Table 4 about here

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In the second model, four background variables (SES, Gender, East Asian Origin, and LEP) were included as time-invariant predictors along with the two variables for Generational Status. The results are displayed in the third column (under Model 2) of Table 4. With the impacts of the four added predictors controlled for, the previously observed advantage of Generation Two students over Generation Three students in growth rate was reduced nearly by half but still significant at the .05 level. The growth rate of the Generation One students, on the other hand, surpassed that of Generation Two students. In other words, with other background characteristics considered, Generation

One students seemed to be the fastest growing group in math achievement. The correlation between the initial status and the growth rate remained minimal ($r = -.06$).

Both SES and East Asian Origin had a significant positive effect on the growth rate. LEP was negatively related with the initial status but positively with the growth rate, both highly significant. The gender gap was minimal in the initial status, as found in earlier regression analysis. However, the gender gap was highly significant ($p < .001$) in the growth rate of math scores in favor of male students.

The third or the full growth model (see Figure 1) added three time-varying variables, namely the Parental Expectation at grades 8, 10, and 12, to the second model and estimated their effects on the corresponding test scores. The results are displayed in the last column of Table 4 under the heading of Model 3.

The new predictors helped to reduce the variance in both the initial status and the growth rate, but the changes they brought to the estimated effects were small. A notable difference was that the correlation between the initial status and the growth rate, as low as -.08, became statistically significant ($p < .05$). At each grade level, the impact of Parental Expectation on math scores was positive and highly significant as found in earlier analyses.

The growth model specifications and estimations for the other three subject areas were not presented here to avoid redundancy of information. The estimated effects of the full growth models for reading, science, and social studies are juxtaposed with those of mathematics in Table 5 for better understanding.

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Insert Table 5 about here

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The generational effects on the initial status (the grade 8 scores) were consistent with earlier analyses. No straightforward pattern was found in the observed generational effects on the growth rate. However, the results did show that after controlling for the impact of the other background characteristics Generation One students had a slightly higher growth rate than Generation Two students in mathematics, reading, and science. In social studies, Generation Two students had a significantly higher growth rate than Generation One students ($p < .01$). At the same time, Generation Two students had significantly higher growth rate than Generation Three students in mathematics, science, and social studies, but not in reading. The correlation between the initial status and the growth rate was negative and significant in math and science, while positive (but not significant) in reading and social studies.

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Insert Table 6 about here

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Table 6 lists the initial statuses and growth rates when the above models were re-estimated using Generation Three as the reference group. It showed that Generation One students had higher growth rate than Generation Three students in all subject areas, and significantly in math and science. So the general finding seemed to be that, with other background characteristics considered, the first two generations of Asian American

students had a higher growth rate in academic achievement than the third generation, especially in math and science.

The impacts of other background variables on the growth rate varied. SES had a significant positive effect in all subject areas. The gender gap was significant in favor of females in reading and significant in favor of males in math. It was not significant in either science or social studies. East Asian Origin had a significant positive effect in math and science. LEP seemed to have a positive effect on the growth rate in math and social studies but a negative effect in reading and science.

The fit indices of the growth models can be found at the bottom of Table 5. As it is known that the chi-square statistic of exact fit tends to be affected greatly by sample size and is highly sensitive to small departures from multivariate normality (Browne & Cudeck, 1993), the chi-square index was supplemented by four approximate fit indices: the Tucker-Lewis Index (TLI), the comparative fit index (CFI), the normed fit index (NFI), and the root mean squared error of approximation (RMSEA). For all the models, TLI, CFI, and NFI values exceeded the .95 criterion for acceptable fit. The values of RMSEA were slightly high. On the whole, these indices indicated a reasonable fit of the models.

To summarize, the results of the second analyses indicated that, similar to the observed generational effects on academic achievement at specific grade levels, the generational differences in the growth rate of academic achievement varied with subject areas. Students of the first two generations had a significantly higher growth rate in mathematics and science, while in social studies Generation Two students had a significantly higher growth rate than the other two groups.

## Discussion

Previous studies have noted the existence of significant immigrant generational impact on the academic performance of Asian American students and recognized students from the second generation as the high-achieving group. However, no analysis has been conducted to explore the generational effect comprehensively in the sense that it is both cross-sectional and longitudinal for all major school subjects. This study sought to reveal the effects of generational status on Asian American student achievement across the three grade levels and the four subject areas surveyed by the NELS study, and to find out whether the pattern of generational difference held after controlling for the influences of other background characteristics. The study also intended to uncover whether Asian American students of different generations differed in their rate of growth in academic achievement, what the pattern of such differences looked like, and how the differences varied among the subject areas in the context of other background characteristics.

The answers to the research questions can be summarized as follows: In terms of the "pre-modeled" test scores, the analyses of the NELS:88 data indicated that Asian American students of the second generation (born in the United States with one or two immigrant parents) outperformed the first and the third or later generations in each subject area at each grade level surveyed by the NELS study. First generation Asian American students who were born outside the country outperformed those of the third or later generations (born in the U.S. with both parents also born in the U.S.), in mathematics, science, and social studies at each grade level (with the exception of the grade 8 science). In reading, however, the difference between the first and the third or later generations was not significant.

When the test scores were modeled with Generational Status and other major background variables (SES, Gender, LEP, East Asian Origin, and Parental Expectation), the academic advantage of second generation students over first generation students remained significant only in reading. On the other hand, first generation students had significantly better performance than the third or later generation students in math and science at each of the three grade levels. In short, when the impacts of other background characteristics were controlled for, Asian American students of the first two generations shared a common edge over those of the third or later generations in math and science, while in reading second generation students achieved the best.

The generational difference in the academic growth of the Asian American students surveyed by the NELS study was also specific to subject areas. The results showed that, before the effects of other background variables were considered, second generation students had a significantly higher growth rates in the test scores of math, reading, science, and social studies than the other two generations, corresponding to their better performance at each grade level. When the effects of other background variables were considered, it was found that second generation students had a higher growth rate than the other two groups only in social studies. First generation students, in fact, had slightly higher growth rates in the other three subject areas although the differences were not statistically significant. However, both first and second generations had significantly higher growth rate than the third or later generations in math and science.

It is clear from this study that the first and second generations of Asian American high school students surveyed by the NELS study tended to have better performance than those of later generations at each grade level and faster academic growth across the high

school years. It is also clear that mathematics and science were the two subject areas that distinguished the first two generations from later generations. These findings confirmed and expanded those of previous studies on the generational difference in Asian American academic performance, and offered further support to the segmented assimilation theory by pointing to an obvious decline of achievement, both cross-sectional and longitudinal, that started with the third immigrant generation.

Among the various explanations for the decline of educational attainment in the third and later generations, the over-assimilation hypothesis (Gibson, 1988; see also Grant & Rong, 1999) says that students of the third and later generations are over-assimilated into American youth culture and, as a result, might share the negative consequences of teenager dating, spending more time on TV and video games than on homework, after school employment, disillusionment about the value of education for social mobility, and weak communication with parents. In this study, the observed generational differences between the first two generations and later generations of the Asian American students were consistent and statistically significant after controlling for socioeconomic status, English proficiency, national origin, and parental expectation. Such findings suggest that traditional indicators of academic achievement are not adequate to account for the generational variance in Asian American student achievement. Further research should be able to test the over-assimilation hypothesis and relevant theories by identifying the behavioral patterns, in school and at home, of Asian American students and exploring how such patterns correspond to the generational differences of academic performance.

Another important feature of the generational difference in Asian American high school student performance revealed by this study is that the difference is subject-specific and the first and second generations excelled in mathematics and science. An easy explanation for this observation is that mathematics and science are two subjects that do not require high fluency in the English language or deep understanding of the American society, and therefore present a "bias" in favor of the first two generations. On the other hand, performance in reading and social studies is supposedly largely related to the exposure to American culture, thus creating another "bias" in favor of the third or later generations (Sun, 1998). While the above proposition needs to be confirmed by a careful content analysis of the tests adopted by the NELS study, a common demographic characteristic of the first two generations - they have one or two parents born in a foreign country - also deserves attention. According to Tuan (1995), for immigrant minorities such as Asian Americans, parents who were first generation immigrants were best able to help their children by investing their resources and keeping them from rapidly or fully assimilating into the American youth culture or oppositional culture. As another challenge to the classical assimilation model that regards immigrants as passive objects of the host environment (Fernandez-Kelly & Schauffler, 1994), Tuan's arguments have found support in two studies that explored the positive impact, respectively, of the parental investment strategies of East Asian American parents (Sun, 1998) and of the formal academic environment provided by Chinese American parents (Hunstinger, Jose, & Larson, 1998). The findings of this study provide support for further research that will explicitly model the demographic, career, and behavioral characteristics of Asian American parents of different generations to account for their children's academic

performance and growth. It is expected that such studies will help to explain why Asian American students with immigrant parents tended to outperform their peers from later generations in certain subject areas (such as mathematics and science).

In conclusion, the study used the data from the base year and two follow-ups of the NELS study to confirm and expand previous researches on the generational difference in Asian American high school student performance. Asian American students of the first two immigrant generations were identified as high achievers. They were also associated with higher growth rate in academic achievement across the high school years, in addition to their better performance at each grade level. At the same time, mathematics and science were identified as the two subject areas where the generational differences in favor of the first two generations were most consistent and robust. These findings were made after controlling for major background characteristics traditionally used to account for academic performance, an observation that calls for further analyses that will explicitly model the behavioral patterns of Asian American students of different immigrant generations and the contextual factors including their parents' demographic, career, and behavioral characteristics, for a better explanation of the generational differences in academic achievement observed in this and other studies.

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Table 1

Average Test Scores of Asian American Students by Generation

| | Generation One (N=441) | Generation Two (N=294) | Generation Three (N=128) |
|---|---|---|---|
| Math | | | |
| Grade 8 | 39.828 [b] | 44.753 [a] | 36.796 |
| Grade 10 | 49.214 [b] | 54.738 [a] | 43.521 |
| Grade 12 | 53.856 [b] | 59.256 [a] | 48.713 |
| Reading | | | |
| Grade 8 | 26.519 | 31.773 [a] | 25.385 |
| Grade 10 | 31.308 | 36.163 [a] | 29.257 |
| Grade 12 | 34.054 | 39.491 [a] | 33.080 |
| Science | | | |
| Grade 8 | 18.768 | 21.268 [a] | 18.401 |
| Grade 10 | 22.686 [b] | 25.048 [a] | 20.834 |
| Grade 12 | 24.397 [b] | 27.065 [a] | 22.855 |
| Social Studies | | | |
| Grade 8 | 30.030 [b] | 31.808 [a] | 28.605 |
| Grade 10 | 32.141 [b] | 34.055 [a] | 30.723 |
| Grade 12 | 35.664 [b] | 38.157 [a] | 34.138 |

[a] Significantly ($p < .05$) higher than Generation One and Generation Three
[b] Significantly ($p < .05$) higher than Generation Three

Table 2

Summary of Background Characteristics of Asian American Students by Generation

| | Generation One (N=441) | Generation Two (N=294) | Generation Three (N=128) | Total (N=863) |
|---|---|---|---|---|
| SES | -.010 | .480 | .252 | .204 |
| Pct. of Female students | 51% | 47% | 50% | 49% |
| Pct. of LEP students | 11.4% | 1.1% | .6% | 5.8% |
| Pct. of East Asian students | 32.2 % | 40.5% | 19.5% | 32.2% |
| Grade 8 Parental Expectation | 5.39 | 5.45 | 4.85 | 5.30 |
| Grade 10 Parental Expectation | 4.22 | 4.48 | 3.73 | 4.21 |
| Grade 12 Parental Expectation | 5.49 | 5.52 | 5.12 | 5.43 |

Table 3

Standardized Regression Coefficients and Proportions of Explained Variance ($R^2$) for Test Scores of Asian American Students by Grade Level and Subject Area

| | Math | Reading | Science | Social Studies |
|---|---|---|---|---|
| | | | Grade 8 | |
| Model 1 | | | | |
| Generation One | -.225 *** | -.276 *** | -.229 *** | -.206 *** |
| Generation Three | -.270 *** | -.260 *** | -.230 *** | -.289 *** |
| $R^2$ | .067 | .077 | .057 | .071 |
| Model 2 | | | | |
| Generation One | -.077 | -.159 *** | -.090 | -.063 |
| Generation Three | -.171 *** | -.183*** | -.143 *** | -.197 *** |
| Female | -.039 | .078 * | -.199 *** | -.039 |
| SES | .301 *** | .276 *** | .252 *** | .313 *** |
| East Asian Origin | .156 *** | .065 | .117 ** | .096 ** |
| Limited English Proficiency | -.120 *** | -.099 ** | -.122 *** | -.098 ** |
| G8 Parent Expectation | .128 *** | .131 *** | .132 *** | .139 *** |
| $R^2$ | .214 | .214 | .226 | .234 |
| | | | Grade 10 | |
| Model 1 | | | | |
| Generation One | -.225 *** | -.260 *** | -.220 *** | -.202 *** |
| Generation Three | -.328 *** | -.273 *** | -.278 *** | -.251 *** |
| $R^2$ | .090 | .077 | .064 | .057 |
| Model 2 | | | | |
| Generation One | -.066 | -.113 ** | -.064 | -.058 |
| Generation Three | -.226 *** | -.219 *** | -.184 *** | -.133 *** |
| Female | -.045 | .120 *** | -.142 *** | -.070 |
| SES | .312 *** | .327 *** | .270 *** | .284 *** |
| East Asian Origin | .130 *** | -.006 | .034 | .027 |
| Limited English Proficiency | -.170 *** | -.160 *** | -.154 *** | -.144 *** |
| G10 Parent Expectation | .146 *** | .108 ** | .158 *** | .220 *** |
| $R^2$ | .289 | .250 | .237 | .244 |
| | | | Grade 12 | |
| Model 1 | | | | |
| Generation One | -.178 *** | -.272 *** | -.202 *** | -.194 *** |
| Generation Three | -.280 *** | -.240 *** | -.227 *** | -.251 *** |
| $R^2$ | .060 | .071 | .050 | .055 |
| Model 2 | | | | |
| Generation One | -.051 | -.134 ** | -.072 | -.087 |
| Generation Three | .221 *** | -.212 *** | -.175 *** | -.213 *** |
| Female | -.080 * | .184 *** | -.156 *** | -.035 |
| SES | .297 *** | .266 ** | .253 | .159 *** |
| East Asian Origin | -.180 *** | .032 | .100 ** | .047 |
| Limited English Proficiency | -.077 * | -.180 *** | -.175 *** | -.117 ** |
| G12 Parent Expectation | .139 *** | .122 ** | .170 *** | .156 *** |
| $R^2$ | .233 | .245 | .225 | .214 |

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Estimated Effects and Model Fit Indices of the Three Growth Models for Mathematics

| | Model 1[a] | Model 2[b] | Model 3[c] |
|---|---|---|---|
| Estimated Effect | | | |
| Initial Status (Generation Two) | 44.941 *** | 41.118 *** | 45.366 *** |
| Growth Rate (Generation Two) | 6.664 *** | 6.445 *** | 7.728 *** |
| Variance (Initial Status) | 139.774 *** | 110.344 *** | 105.503 *** |
| Variance (Growth Rate) | 20.177 *** | 17.842 *** | 16.164 *** |
| r (Initial Status and Growth Rate) | -.038 | -.056 | -.082 * |
| Initial Status on Generation One | -4.994 *** | -1.321 | -1.244 |
| Initial Status on Generation Three | -7.920 *** | -6.108 *** | -6.514 *** |
| Growth Rate on Generation One | -.094 | .210 | .272 |
| Growth Rate on Generation Three | -.939 ** | -.455 * | -.343 * |
| | | | |
| Initial Status on Female | | -.059 | .025 |
| Initial Status on SES | | 5.488 *** | 5.761 *** |
| Initial Status on East Asian Origin | | 3.873 *** | 4.040 *** |
| Initial Status on Limited English | | -6.918 *** | -6.923 *** |
| Growth Rate on Female | | -1.310 *** | -1.240 *** |
| Growth Rate on SES | | .772 *** | .877 *** |
| Growth Rate on East Asian Origin | | .810 ** | .643 ** |
| Growth Rate on Limited English | | 2.135 *** | 2.422 *** |
| | | | |
| G8 Math on G8 Parent Expectation | | | .877 *** |
| G10 Math on G10 Parent Expectation | | | .582 *** |
| G12 Math on G12 Parent Expectation | | | .744 *** |
| | | | |
| Model Fit Indices | | | |
| Chi-square (df) | 193.693 (3) | 243.443 (7) | 596.939 (31) |
| TLI | .910 | .941 | .971 |
| CFI | .982 | .975 | .969 |
| NFI | .982 | .974 | .950 |
| RMSEA | .274 | .136 | .131 |

[a] Dummy variables (Generation One, Generation Three) as time-invariant predictors
[b] SES, Female, East Asian Origin, LEP added as time-invariant predictors
[c] Parental Expectation for Grade 8, 10, and 12 added as time-varying predictors
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5

Estimated Effects and Model Fit Indices of the Full Growth Models for Mathematics, Reading, Science, and Social Studies

| | Mathematics | Reading | Science | Social Studies |
|---|---|---|---|---|
| Estimated Effect | | | | |
| Initial Status (Average of Generation Two) | 45.366 *** | 31.056 *** | 20.702 *** | 29.241 *** |
| Growth Rate (Average of Generation Two) | 7.728 *** | 5.268 *** | 2.738 *** | 4.471 *** |
| Variance (Initial Status) | 105.503 *** | 52.001 *** | 18.469 *** | 12.943 *** |
| Variance (Growth Rate) | 16.164 *** | 6.033 *** | 3.429 *** | 2.095 *** |
| Initial Status on Generation One | -1.244 | -2.976 *** | -1.168 | -0.415 |
| Initial Status on Generation Three | -6.514 *** | -6.040 *** | -2.321 *** | -2.427 *** |
| Growth Rate on Generation One | .272 | .280 | .241 | -.394 * |
| Growth Rate on Generation Three | -.343 * | .059 | -.512 ** | -.520 ** |
| Initial Status on Female | .025 | 1.960 *** | -1.426 *** | -.333 |
| Initial Status on SES | 5.761 *** | 3.995 *** | 1.867 *** | 2.048 *** |
| Initial Status on East Asian Origin | 4.040 *** | .445 | .820 ** | .779 ** |
| Initial Status on Limited English | -6.923 *** | -3.725 *** | -2.746 *** | -2.569 *** |
| Growth Rate on Female | -1.240 *** | .688 *** | -.149 | -.020 |
| Growth Rate on SES | .877 *** | .609 *** | .408 *** | -.027 |
| Growth Rate on East Asian Origin | .643 ** | .252 | .295 * | .048 |
| Growth Rate on Limited English | 2.422 *** | -.097 | -.747 ** | .298 * |
| G8 Score on G8 Parent Expectation | .877 *** | .752 *** | .621 *** | .516 *** |
| G10 Score on G10 Parent Expectation | .582 *** | .692 *** | .574 *** | .555 *** |
| G12 Score on G12 Parent Expectation | .744 *** | .710 *** | .683 *** | .723 *** |
| r (Initial Status and Growth Rate) | -.082 * | .017 | -.153 * | .076 |
| Model Fit Index | | | | |
| Chi-square (df) | 596.939(31) | 574.718 (31) | 486.754 (31) | 481.918 (31) |
| TLI | .971 | .950 | .954 | .960 |
| CFI | .969 | .970 | .975 | .978 |
| NFI | .950 | .968 | .973 | .976 |
| RMSEA | .131 | .129 | .119 | .118 |

* $p < .05$, ** $p < .01$, *** $p < .001$

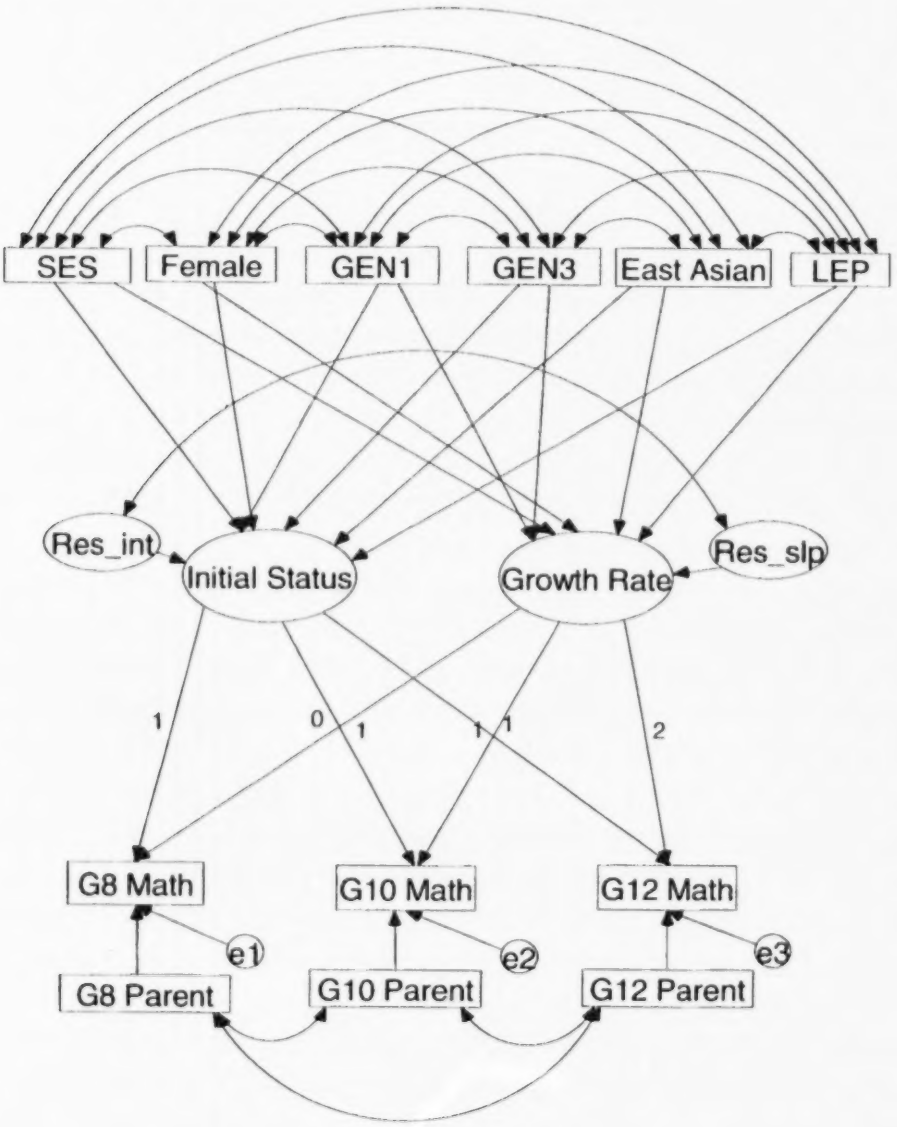
Table 6

Estimated Initial Statuses and Growth Rates with Generation Three as the Reference

| | Mathematics | Reading | Science | Social Studies |
|---|---|---|---|---|
| Initial Status on Generation One | 5.271 *** | 3.018 *** | 1.154 ** | 2.012 *** |
| Initial Status on Generation Two | 6.514 *** | 6.040 *** | 2.321 *** | 2.427 *** |
| Growth Rate on Generation One | .615 ** | .230 | .770 *** | .136 |
| Growth Rate on Generation Two | .343 * | -.059 | .512 ** | .520 ** |

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 1. Path Diagram of the Full Growth Model of Mathematics Scores



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